BROCADE® SES

(SCSI-3 Enclosure Services)
Reference Manual
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Note Regarding Applicability of the BROCADE® SCSI-3 Enclosure Services (SES) Reference Manual to Hewlett-Packard

The *BROCADE SCSI-3 Enclosure Services (SES) Reference Manual* describes how to monitor, configure, and maintain the Brocade SilkWorm switch family via BROCADE SCSI-3 Enclosure Services (SES). The following describes the extent to which this manual is applicable to Hewlett-Packard.

References to the following are not applicable:

- Model numbers
- Optional licensing information
- Part numbers
- Copper

The front matter (Notices, TOC, Preface) is applicable, with the following exceptions:

- Related Publications – Hewlett-Packard part numbers are as follows: *Hardware Reference Manual* A5624-90902, *Fabric OS* A5624-90903, *Zoning* A5624-90904, *QuickLoop* A5624-90905, *Web Tools User's Guide* A5624-90906, and *SCSI-3 Enclosure Services (SES) User's Guide* A5624-90907.

Chapter 1 (Introducing SES) is applicable, with the following exception:

- Optionally licensed products are standard.

Chapter 2 (Installing SES) is applicable, with the following exception:

- Optionally licensed products are standard.

Chapter 3 (SES Concepts) is applicable, with the following exceptions:

- Optionally licensed products are standard.

Chapter 4 (SES Commands) is applicable, with the following exceptions:

- Optionally licensed products are standard.

Chapter 5 (Troubleshooting) is applicable.

Appendix A (Glossary) is applicable.

Appendix B (SES Specifications) is applicable.

Appendix C (Customer Support) is not applicable. Refer to your Hewlett-Packard support contract for support information.

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PREFACE

The SES Reference Manual describes how to monitor, configure, and maintain the SilkWorm Switch Family via SCSI-3 Enclosure Services (SES).

Audience

The audience for this manual includes:

- Field Technicians
- System Administrators

How this Manual is Organized

The following table describes how the manual is organized.

FOR INFORMATION ON	SEE
SES features	*Introducing SES* on page 1-1
Installing and setting up the Brocade SES	*Installing SES* on page 2-1
SES operational concepts	*SES Concepts* on page 3-1
SES Commands and examples	*SES Commands* on page 4-1
Diagnostics and troubleshooting	*Troubleshooting* on page 5-1
SES terminology	*Glossary* on page A-1
Technical specifications	*SES Specifications* on page B-3
Customer support and software upgrades	*Customer Support* on page C-1

Related Publications

Other publications that may provide related information include:

- *Fibre Channel Standards*

For detailed information on the Fibre Channel standards, see the Fibre Channel Association web site:

http://www.fibrechannel.com

- *Fabric OS* (53-0001551-01)

1

INTRODUCING SES

This chapter describes SES (SCSI-3 Enclosure Services) on the SilkWorm family of switches. SES requires an optional license key to activate fully. Without a license the only commands shown in *Basic FCP Commands* on page 4-5 are supported. With a license the commands shown in *SES Commands and Diagnostic Pages* on page 4-10 are also supported.

SES implementation in a SCSI-3-based Host Adapter is up to the adapter manufacturer. Therefore, the focus of this guide is to discuss SilkWorm's implementation of SES within the Fabric.

NOTE: *Currently, the SES standard is in DRAFT status and is subject to change. See "Related Publications" on page viii for a pointer to the SES Standards Committee's web site.*

SES Management

SES is an in-band mechanism for managing devices, such as SilkWorm switches, within a Fabric or other enclosures. SES commands are used to manage and sense the operational status of the power supplies, cooling devices, displays, indicators, individual drives, and other non-SCSI elements installed in a switch (enclosure). The command set uses the SCSI `SEND DIAGNOSTIC` and `RECEIVE DIAGNOSTIC RESULTS` commands to obtain/set configuration information from the switch.

SES allows a SCSI entity (or initiator) to communicate with a switch via a standard Fiber Channel Protocol (FCP) connection into the Fabric. The benefits are:

- SES does not require supporting another protocol
- SES does not require an additional network link (such as Ethernet)

Figure 1-1 shows the Fabric SES view. The switch's `Domain_ID` is used as the Logical Unit Number (LUN) address to identify each switch including the switch used for access via SES. See *SES Functional Model* on page 3-2 for more information. Note that the connection to the Fabric is via the switch labeled `LUN L5` and which is also called `LUN 0`. The connection to the well known management address (`FFFFFAh`) is always labeled `LUN 0` (value in hex is `00000000 00000000`) no matter which switch is used. Additionally, there can also be a `LUN L0` with a hex value of `01000000 00000000`.

Figure 1-1 also shows the switch in the lower left hand corner is assigned both `LUN L5` and `LUN 0`. `LUN L5` because the switch's `Domain_ID` is `L5` and `LUN 0` because the client is physically connected to that switch.

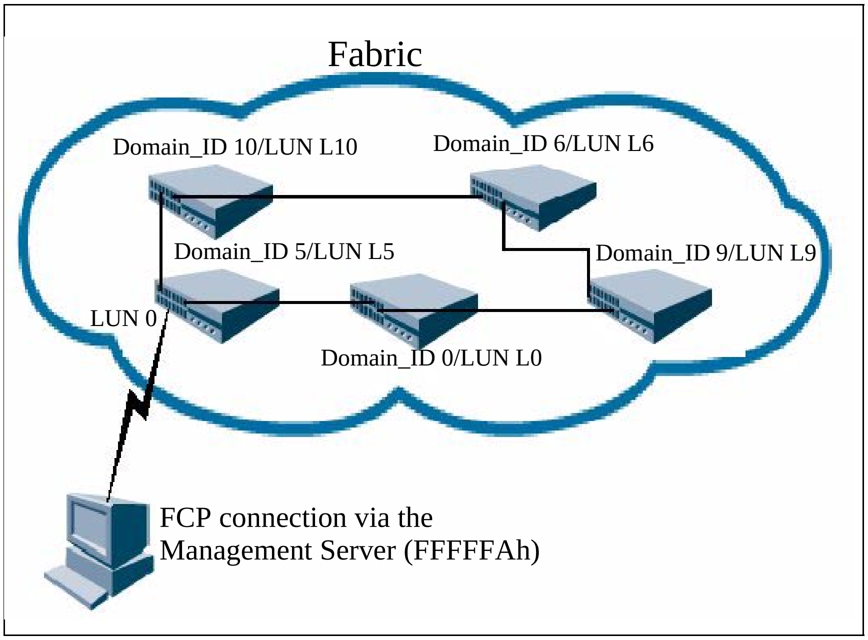

Figure 1-1 SES Overview

LUN addressing within the Fabric is based on the switch's `Domain_ID`. Table 1-1 shows a sample LUN mapping used with Figure 1-1. See Table 3-1 on page 3-2 for a further discussion of LUN value assignments by the SES support within the Fabric.

Table 1-1 Example LUN Mapping

Label	Domain ID	Unique LUN Value (in Hex)
LUN 0	5	00000000 00000000 (Note that for both LUN 0 and 0105000000000000h are supported for switch domain 5 in this example)
L0	0	01000000 00000000
L5	5	01050000 00000000
L6	6	01060000 00000000
L9	9	01090000 00000000
L10	10	010A0000 00000000

Outside the Fabric other SCSI-3 enclosures can also run SES. For example, JBODs, RAID-5 arrays, SCSI-3 hard drives, SCSI-3 tape drives and so on. These devices are identified by their Fabric and SCSI addresses, and are assigned LUNs using standard SCSI-3 host adapter LUN addressing.

It is not this guide’s intent to describe the environment outside of the Fabric.

2

INSTALLING SES

This chapter includes information for:

- License Installation

License Installation

SES requires a license to operate. Without a License Key installed in the SilkWorm Switch you cannot enable SES. Note that a License Key may have been installed at the factory.

For a License Installation:

1 Log on the switch via Telnet (see *Fabric OS reference)*

2 On the Telnet command line, type:

licenseShow

Verify the current license keys, for example:

```
admin> licenseShow
9S9RzSebeATAS0k:
 Web license
 Zoning license
 SES license
```

If the SES license is not installed continue with Step 3.

3. On the Telnet command line, type:

   licenseAdd "key"

   where, *"key"* is the license key string of alphanumeric characters in double quotes (*"key"*) that must be entered exactly as given including case. For example, *"RdxS9S9ezSdcdTs"*.

   NOTE: *If an invalid license key is entered the existing license (if any) is overwritten, thus eliminating any/all valid license keys.*

4. Once the license is entered, check for it with the *licenseShow* command and if present reboot the switch.

3

SES CONCEPTS

You must have a license key installed to access SES, to verify key activation see *License Installation* on page 2-1 for information.

SES is distributed transparently throughout the Fabric, with an instance of a distributed SES Device (SESD) on each switch as shown in Figure 3-1.Without the license key on a particular switch, the associated SESD would only respond to the basic set of FCP commands as defined in Table 4-2 on page 4-3.

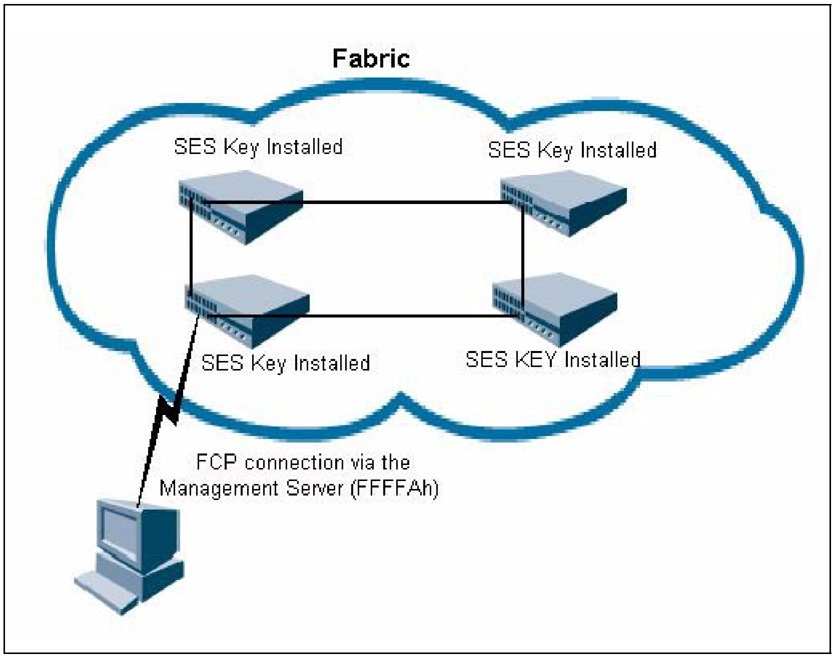

Figure 3-1 SES Distribution

SES Functional Model

Each instance may be accessed by an SES Application Client by specifying the associated unique Logical Unit Number (LUN). See Figure 3-2 for information on LUN addressing. Additionally, SilkWorm's SES implementation also provides an SES Application Client an in-band mechanism for managing any Fabric switch that it is attached to.

Figure 3-2 shows SilkWorm's SES functional model.

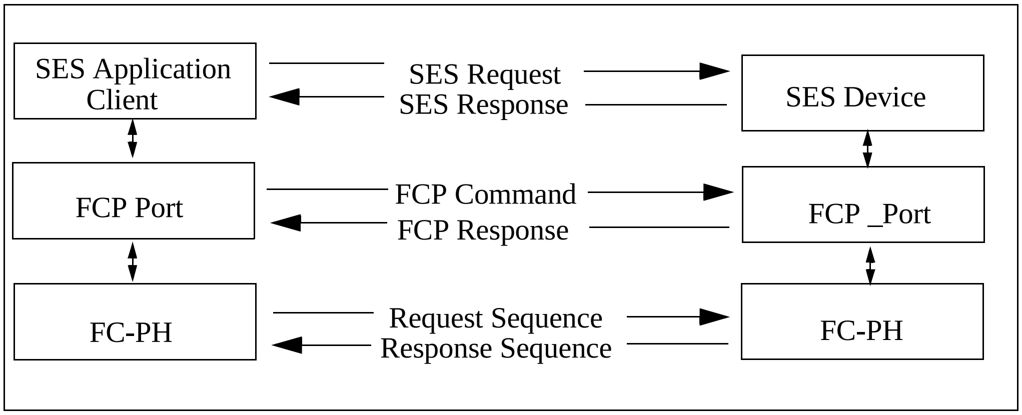

Figure 3-2 SES Functional Model

At the Fibre Channel level, each SESD is accessible via the Fibre Channel well known address, `FFFFFAh` (Management Server). At the SCSI-3 level, it is associated with a LUN. An SES Application Client can refer to any distributed SESD within the Fabric using its LUN. A LUN value of 0 is always associated with the local switch that is physically attached to the SES Application Client. The unique LUN value is mapped based on peripheral device addressing.

The bus number for each switch is set to `010000b` as shown in Table 3-1. Byte 1 of the Target/LUN is set using the `Domain_ID` of the switch. Bytes 2..7 are set to zero.

Table 3-1 Format of LUN recognized by SESD

BYTE/BIT	7	6	5	4	3	2	1	0
0	0	0	Bus Number = 010000b					
1	Target							
...	or							
7	Logical Unit Number (LUN)							

Table 3-2 shows the LUN mapping.

Table 3-2 LUN Mapping

DOMAIN ID		UNIQUE LUN VALUE (IN HEX)
0	0h	01000000 00000000
5	5h	01050000 00000000
12	Ch	010C0000 00000000
15	Eh	010F0000 00000000
25	19h	01190000 00000000

An SES Application Client may easily find the LUN values of all distributed SESDs inside the Fabric by using the Report LUNs command (see *Report LUNs* on page 4-8).

Access to the Enclosure Services Process

With SES instances distributed throughout a Storage Area Network (SAN). An application client can monitor all enclosures capable of processing the enclosure services command set. Enclosure services can monitor both devices inside and outside of the enclosure. For example, an Uninterruptable Power Supply (UPS). However, Silkworm's SES pertains only to SES instances inside the Fabric.

An application client connects via Fiber Channel Protocol (FCP) using the Management Service address (`FFFFAh`) to any SilkWorm switch via its LUN, see Figure 1-1 on page 1-2. The enclosure services command set uses the `RECEIVE DIAGNOSTIC RESULTS` and `SEND DIAGNOSTIC` commands to any device capable of supporting SES.

Access Via an Enclosure Services Device

The application client requests information from the SESD to examine status and warning information from the switch.

An application client via FCP calls the enclosure services process running on any SilkWorm Switch as an LUN that has SES enabled. The SESD sets the enclosure services bit (`EncServ`) in the `INQUIRY` command (see *Inquiry* on page 4-5 for more information) to indicate that it can transport enclosure services information.

Indicators and Control Management

SESD is accessed via an application client that uses the `SEND DIAGNOSTIC` command to transport control information to the enclosure services process. The control information may include operations to perform or to modify its operating mode. The application client uses the `RECEIVE DIAGNOSTIC RESULTS` command with the `PF` bit set to obtain enclosure status. The information returned indicates the actual enclosure state. See *Receive Diagnostic Results* on page 4-10 for more information.

Additionally, the instructions from the application client may be ignored or overwritten by the enclosure service processor to ensure proper state information. For example, the enclosure may ignore an instruction to clear an error condition because the condition is valid or because the instruction is not supported by the enclosure.

4

SES COMMANDS

SESD can be accessed from any Fabric switch licensed to run SES.

This chapter contains information and examples on managing SES, including:

- FCP Constructs
- Basic FCP Commands
- SES Commands and Diagnostics Pages

Constructs, Commands and Diagnostic Pages

Table 4-1 summarizes the FCP constructs, basic FCP commands, and SES commands and Diagnostics Pages:

Table 4-1 Constructs, Commands and Diagnostic Pages

TYPE	COMMAND	DESCRIPTION	SEE PAGE
See *FCP Constructs* on page 4-3	FCP Information Unit	SCSI Command to be executed or a task management request	4-3
	FCP Transfer Ready Information Unit	Contains SCSI-3 data delivery service parameters	4-4
	FCP Data Information Unit	Transfers data	4-4
	FCP Response Information Unit	Contains status and sense information	4-4

Table 4-1 Constructs, Commands and Diagnostic Pages

TYPE	COMMAND	DESCRIPTION	SEE PAGE
See *Basic FCP Commands* on page 4-5	Inquiry	Contains information about the devices and sensors in an enclosure	4-5
	Report LUNs	Contains information returned from SESD containing the LUNs attached to the SESD	4-8
	Request Sense	Used to sense information from the SESD	4-8
	Test Unit Ready	Used to test the operation state of a LUN	4-9
	Reject	Contains information and status about a unit's failure	4-9
See *SES Commands and Diagnostic Pages* on page 4-10	Receive Diagnostics Results	Contains information returned by the SESD about an enclosure	4-10
	Send Diagnostic	Used to configure/diagnose a logical unit	4-11
	Supported Diagnostics Pages	Contains the diagnostic pages supported	4-11
	Switch Page	Contains status information about the switch, its operational state and firmware	4-13
	Sensor Table Page	Contains status information about the state of all sensors in the switch.	4-15
	Fabric Page	Contains information about the Fabric, its neighbors and Domain_ID	4-16
	Neighborhood Table Page	Contains information about the switches neighbors in the Fabric	4-17
	Fibre Channel Port Table Page	Contains information about the switches Fibre Channel ports	4-18
	Name Server Local Table Page	Contains information about the SESD	4-21
	Port Error and Interrupt Statistics Table Page	Contains information about the port errors and interrupt statistics	4-23
	Fabric Inquiry Data Page	Contains information about Fabric data	4-25
	MIB-II System Group Page	Contains information about the MIB-II system group	4-26
	PortLog Table Page	Contains information about the port log	4-28

FCP Constructs

Before initiating any FCP request, the N_Port associated with the SES Application Client (FCP Initiator) must complete an N_Port Login (`PLOGI`) with the Management Server in Class 2 or 3. The destination address in the PLOGI request must be set to `FFFFFAh`. The FCP Process Login (PRLI) is not required but supported by the SESD.

The format of an FCP Command (`FCP_CMND`), FCP Transfer Ready (`FCP_XFER_RDY`), FCP Data (`FCP_DATA`) and FCP Response (`FCP_RSP`) conforms to those defined in the *SCSI-3 Fibre Channel Protocol (FCP), Revision 12, X3T10/269, working draft*.

Table 4-2 FCP Information Unit Descriptions

FCP INFORMATION UNIT	DESCRIPTION
`FCP_CMND`	The Information Unit contains a SCSI Command to be executed or a task management request on a target.
`FCP_XFER_RDY`	The Information Unit indicates that the target is ready to perform the data transfer associated with a FCP_CMD.
`FCP_DATA`	The data associated with an I/O operation.
`FCP_RSP`	The Information Unit contains status and sense information

FCP Command Information Unit

Table 4-3 shows the `FCP_CMND` Information Unit (IU) that carries either a SCSI command to be executed or a task management request to be performed. It contains the values and control fields defined in its payload.

Table 4-3 FCP_CMND IU Format

BYTE SIZE	FIELD NAME	BYTE NUMBER	DESCRIPTION
8	FCP_LUN	0 - 7	Logical Unit Number
4	FCP_CNTL	8 - 11	Control flags and bits for task/execution management
16	FCP_CDB	12 - 27	SCSI command descriptor block
4	FCP_DL	28 - 31	Data Length

The `FCP_LUN` value format is described in Table 3-1 on page 3-2 or the value is 0. The latter refers to the SESD on the **local** switch. The `FCP_CNTL` value is set to 1, 2 or 0 depending on whether *READ DATA*, *WRITE DATA* or neither is involved in the command. The `FCP_CDB` value contains the appropriate command descriptor. The `FCP_DL` field contains a count of the maximum number of data bytes to be transferred to or from the target for the command.

FCP Transfer Ready Information Unit

The `FCP_XFER_RDY` Information Unit contains SCSI-3 data delivery service parameters required by the initiator and must be transmitted preceding each read or write `FCP_DATA IU`.

FCP Data Information Unit

The `FCP_DATA` Information Unit transfers the actual data.

FCP Response Information Unit

Table 4-4 shows the `FCP_RSP` that carries the response status and sense information associated with a particular `FCP_CMND`.

Table 4-4 FCP_RSP Format

BYTE SIZE	**FIELD NAME**	**DESCRIPTION**
8	Reserved	Reserved
4	FCP_STATUS	Status of the (linked/previous) request
4	FCP_RESID	Residual Count
4	FCP_SNS_LEN	Length of Sense Information (FCP_SNS_INFO)
4	FCP_RSP_LEN	Length of Response Information (FCP_RSP_INFO)
m	FCP_RSP_INFO	FCP Response Information (FCP_RSP_INFO)
n	FCP_SNS_INFO	SCSI Sense Information (FCP_SNS_INFO)

Table 4-5 shows the `FCP_STATUS` field format.

Table 4-5 FCP_STATUS Format

BYTE	**BIT**	**DEFINITION**
0	7 .. 0	Reserved
1	7 .. 0	Reserved
	7 .. 4	Reserved
	3	FCP_RESID_UNDER
2	2	FCP_RESID_OVER
	1	FCP_SNS_LEN_VALID
	0	FCP_RSP_LEN_VALID
3	7 .. 0	SCSI status byte from the SCSI logical unit (not used)

The reserved bits are set to 0 by the SESD. `FCP_RESID_UNDER` indicates that the `FCP_RESID` field (Table 4-4) is valid and contains the number of bytes expected to be transferred, but were not transferred. This bit is not used by SESD. `FCP_RESID_OVER` indicates that the `FCP_RESID` field is valid and contains the number of bytes that have been truncated because the `FCP_DL` (Table 4-3) was not sufficient. This bit may be set by SESD.

Basic FCP Commands

Table 4-6 shows the commands supported by SESD.

Table 4-6 Supported Operation Codes for Basic Commands

COMMAND	OPERATION CODE	SEE PAGE
Inquiry	12h	4-5
Report LUNs	A0h	4-8
Request Sense	03h	4-8
Test Unit Ready	00h	4-9

Note that in each command the value of the `FCP_LUN` field in `FCP_CMND` specifies the logical unit for the request. The value of `FCP_DL` field in `FCP_CMND` specifies whether there is any data parameter to be transferred to the SESD. The value should be 0 for these basic commands.

Inquiry

An SES Application client may send an `Inquiry` command is used to obtain information about a switch in the Fabric. The format of the `FCP_CDB` is shown in Table 4-7.

Table 4-7 Inquiry Format

BYTE/BIT	7	6	5	4	3	2	1	0
0	Operation Code = 12h							
1	Reserved						CmdDt=0	EVPD=0
2	Page Code							
3	Reserved							
4	Allocation Length							
5	Control = 0							

If the field, `EVPD` (Enable Vital Product Data) is set to 0, the value of the Page Code is ignored by SESD.

The SESD returns the standard `Inquiry Data` as shown in Table 4-8.

Table 4-8 Standard Inquiry Data Format

BYTE/ BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Peripheral Qualifier = 0			Peripheral Device Type = 0Dh				
1	RMB=0	Reserved = 0						
2	ISO version = 0		ECMA version = 0			ANSI version = 3		
3	AERC=0	TrmTsk=0	NormACA=1	Reserved=0	Response data format = 2			
4	Additional Length = 31 (1Fh)							
5	Reserved							
6	Reserved	EncServ=1	VS = 0	MultiP=1	MChngr=0	ACKREQQ=0	Addr32=0	Addr16=0
7	RelAdr=0	WBus32=0	Wbus16=0	Sync=0	Linked=0	Trandis=0	CmdQue=0	VS=0
8 ..15	Vendor identification = (by default the value is ”BROCADE”)							
16 .. 31	Product identification = (by default the value is “FC Switch”)							
32 .. 35	Product revision level = “v{*N*}{*m*}{*p*}’” (where {N} is a single number designating the major release number, {m} is a single number designating the minor release number), and {p} is a single alpha character designating a patch. There may be a space indicating there’s no patch. For example, v20							

If the switch does not have the SES license key, the following is returned:

- `Peripheral Device Type = 1Fh` (for unknown or no device type)
- `EncServ = 0`

If `EVPD` is set to 1, then the value of the Page Code may be set to one of the followings:

PAGE CODE	**DESCRIPTION**
00h	Supported vital product data pages
80h	Unit Serial Number Page
83h	Device Identification Page

If the page code is set to 00h, the SESD returns the following:

BYTE/BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Peripheral qualifier = 0			Peripheral Device Type = 0Dh (for Enclosure services device)				
1	Page Code = 00h							
2	Reserved							
3	Page length = 3							
4	00h							

BYTE/BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
5	80h							
6	83h							

If the page code is set to 80h, the SESD returns the following:

BYTE/BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Peripheral qualifier = 0			Peripheral Device Type = 0Dh				
1	Page Code = 80h							
2	Reserved							
3	Page length = 24							
4	Product Serial Number = *the switch World_wide Name in ASCII string format* E.g. “10:00:00:60:69:00:01:b4 ”							
...								
27								

If the page code is set to 83h, the SESD shall return the following:

BYTE/BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Peripheral qualifier = 0			Peripheral Device Type = 0Dh				
1	Page Code = 83h							
2	Reserved							
3	Page length = 32							
4	Reserved = 0				Code set = 2			
5	Reserved = 0				Identifier type = 1			
6	Reserved = 0							
7	Identifier length = 28							
8	Identifier = Vendor Identification (8 bytes) + Product identification (16 bytes) + Product revision level (4 bytes) **NOTE:** *See Table 4-8.*							
...								
35								

If the switch does not have the SES license key, `Peripheral Device Type` as shown in the two tables above is set to `1Fh`.

Report LUNs

An SES Application client sends a `Report LUNs` command to obtain the number of logical units (each is a switch in SCSI impersonation) in the Fabric. The `FC_CDB` format is shown in Table 4-9.

Table 4-9 Report LUNs Command Format

BYTE/BIT	7	6	5	4	3	2	1	0
0	Operation Code = A0h							
1 .. 5	Reserved							
6 .. 9	Allocation Length							
10	Reserved							
11	Control = 0							

The SESD reports the Logical Unit Numbers of associated switches with the format shown in Table 4-10.

Table 4-10 Reported LUNs Format

BYTE	DESCRIPTION
0 .. 3	LUN list length (*n*-7) in unit of bytes
4 .. 7	Reserved
8 .. 15	0
..	..
(*n*-7)..*n*	LUN Lj

For the Fabric configuration shown in Figure 1-1 on page 1-2, the LUN list length is 48, the LUN list consists of 0, L0, L5, L6, L9 and L10.

Request Sense

An SES Application client sends a `Request Sense` command to obtain sense data. The `CDB` format is shown in Table 4-11.

Table 4-11 Request Sense Command Format

BYTE/BIT	7	6	5	4	3	2	1	0
0	Operation Code = 03h							
1 .. 3	Reserved							
4	Allocation length							

Table 4-11 Request Sense Command Format

BYTE/BIT	7	6	5	4	3	2	1	0
5	Control = 0							

The SESD returns a sense key of `NO SENSE` and an additional sense code of `NO ADDITIONAL SENSE INFORMATION`.

Test Unit Ready

An SES Application Client sends a `Test Unit Ready` command to check if the logical unit is ready. The `FCP_CDB` format is shown in Table 4-12.

Table 4-12 Test Unit Ready Command Format

BYTE/BIT	7	6	5	4	3	2	1	0
0	Operation Code = 00h							
1 .. 4	Reserved							
5	Control = 0							

The SESD returns the status of `GOOD` and `CHECK CONDITION` and a sense key of `NO SENSE` and an additional sense code of `NO ADDITIONAL SENSE INFORMATION`.

Reject

The SESD issues a `Reject` command to set status to `Check Condition` and the appropriate values for the Sense Key (`SK`) field. Additional Sense Code (`ASC`) and Additional Sense Code Qualifier (`ASCQ`) values are as shown in Table 4-13.

Table 4-13 Reject Command Format

SK	ASC	ASCQ	EXPLANATION
2	04h	0	Logical Unit not ready
2	35h	0	Enclosure Service failed
2	35h	2	Enclosure Service unavailable (memory allocation problem)
5	1Ah	0	Parameter List length error (too small or too big)
5	20h	0	Invalid command operation code
5	25h	0	Logical Unit not supported (invalid LUN value in FCP_CDB)

SES Commands and Diagnostic Pages

Table 4-14 shows the commands supported by SESD.

Table 4-14 Supported Operation Codes for SES Commands and Diagnostic Pages

COMMAND	OPERATION CODE	SEE PAGE
Receive Diagnostics Results	1Ch	4-10
Send Diagnostic	1Dh	4-11

Note that in each command the value of the `FCP_LUN` field in `FCP_CMND` specifies the logical unit for the request. The value of `FCP_DL` field in `FCP_CMND` specifies whether there is any data parameter to be transferred to the SESD. For Receive Diagnostics Results, the value may be 0 or the size of a diagnostic page defined in Table 4-18.

Receive Diagnostic Results

An SES Application client sends a `Receive Diagnostic Results` command to return *diagnostic* or *management* data. The `FCP_CDB` format is shown in Table 4-15.

Table 4-15 Receive Diagnostic Results Command Format

BYTE/BIT	7	6	5	4	3	2	1	0
0	Operation Code = 1Ch							
1	Reserved							PCV
2	Page Code							
3 .. 4	Allocation Length							
5	Control = 0							

A Page Code Valid (`PCV`) bit of zero indicates that the most recent `Send Diagnostic` command defines the data returned by this command. A value of 1 indicates that the Page Code field defines the data to be returned for this command. The page codes and formats are defined in *Switch Diagnostics Pages* on page 4-12.

Send Diagnostic

An SES Application client can use a `Send Diagnostic` command to configure/ diagnose a logical unit. After the command completion, the SES Application client sends a `Receive Diagnostic Results` command (see Table 4-15 on page 4-10). The `FCP_CDB` format is shown in Table 4-16.

Table 4-16 Send Diagnostic Command Format

BYTE/BIT	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Operation Code = 1Dh							
1	Reserved			PF	Reserved	selfTest	DevOfL	UnitOfL
2	Reserved							
3 .. 4	Parameter list length (in bytes)							
5	Control = 0							

A Page Format (`PF`) bit of 1 specifies that the `Send Diagnostic` parameters conform to the page structure as specified in *SCSI-3 Primary Command (SPC), Revision 11a, X3T10/995D, working draft*. A value of 0 specifies that all parameters are vendor-specific. At present, the SESD only supports the vendor-specific page structures as defined in *Switch Diagnostics Pages* on page 4-12.

The `selfTest`, `DevOfL` and `UnitOfL` bits are ignored by the SESD at present.

The parameter list length field specifies the length in bytes of the parameter list that shall be transferred from the SES Application client to the SESD.

Supported Diagnostics Pages

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command, the SESD returns the response shown in Table 4-17.

Table 4-17 Page Code 0 Format (Supported Diagnostic Pages)

BYTE	**DESCRIPTION**
0	Page Code = 00h
1	Reserved
2	(MSB)
3	Page Length = 11 (in bytes) (LSB)
4	00h
5	80h
6	81h

Table 4-17 Page Code 0 Format (Supported Diagnostic Pages)

BYTE	DESCRIPTION
7	82h
8	83h
9	84h
10	85h
11	87h
12	8Ah
13	90h
14	B0h

Switch Diagnostics Pages

Before each SCSI command is discussed in detail, the diagnostics pages are defined as shown in Table 4-18. They are particularly relevant to two commands: `Receive Diagnostic Results` and `Send Diagnostics`. The switch SESD supports the following diagnostics pages.

Table 4-18 Diagnostics Pages

PAGE CODE	DESCRIPTION
00h	Supported Diagnostics Pages
80h	Switch Page
81h	Sensor Table Page
82h	Fabric Page
83h	Neighborhood Table Page
84h	Fibre Channel Port Table Page
85h	Name Server Local Table Page
87h	Port Error and Interrupt Statistics Table Page
8Ah	Fabric Inquiry Data Page
90h	MIB-II System Group Page
B0h	Portlog Dump Page

Table 4-19 shows the Page Codes 80h through 85h which are Vendor Specific Pages and are *roughly* mapped from the switch Management Information Base (MIB) Definition for v2.0 Fabric Operating System (FOS).

Table 4-19 Switch MIB Groups

PAGE CODE	SWITCH MIB GROUP
80h	System Group, variables 1..8, 20, 21
81h	System Group, Sensor Table
82h	Fabric Group, variables 1, 2 and 8
83h	Fabric Group, Neighborhood Table
84h	Fibre Channel Port Table
85h	Name Server Local Table

Other than pages 0 and B0h, the Diagnostics Pages generally contains in the first four bytes the Page Code, Reserved byte and a two byte Page Length. In addition, the field called `swValidity` (or `swValidity[i]` in cases where there are multiple entries to a table). The field is used to indicate which subsequent data fields are valid. Each subsequent data field has an associated field number. If the data field is valid, its associated bit in `swValidity` is set. In most cases, all data fields are valid in the response to `Receive Diagnostic Result` command. For example, if data fields 0, 1 and 2 are valid, then the related `swValidity` field contains the value 7. This is also a flexible mechanism for the `Send Diagnostic` command to indicate which data fields the client wishes to *write* into.

Switch Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command the SESD returns the responses shown in Table 4-20. Table 4-21 describes the fields.

Table 4-20 Switch Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	rw	Page Code = 80h	1
1	na	na	Reserved = 0	1
2 .. 3	na	na	Page Length = 404	2
4 .. 7	na	rw	swValidity = 3FFh	4
8 .. 71	0	ro	Current_Date (in ASCII text)	64
72 .. 135	1	ro	Boot_Date (in ASCII text)	64
136 .. 199	2	ro	Firmware_Last_Updated_Date (in ASCII text)	64

Table 4-20 Switch Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
200 .. 263	3	ro	FLASH_Last_Updated_Date (in ASCII text)	64
264 .. 327	4	ro	Boot_PROM_Last_Updated_Date (in ASCII text)	64
328 .. 391	5	ro	Firmware_Version_Information (in ASCII text)	64
392 .. 395	6	ro	Switch_Operational_Status	4
396 .. 399	7	rw	Switch_Administrative_Status	4
400 .. 403	8	ro	Diagnostics_Result	4
404 .. 407	9	ro	Number_of_Sensors	4
Note: na is not available, ro is read only and rw is read/write				

Table 4-21 Switch Page Field Descriptions

FIELD	DESCRIPTION
`Current_Date`	The current date and time. For example, `Wed Feb 10 15:04:28 1999`.
`Boot_Date`	The boot date and time.
`Firmware_Last_Updated_Date`	The last date and time the FOS was updated.
`FLASH_Last_Updated`	The last date and time the flash memory was updated.
`Boot_PROM_Last_Updated_Date`	The last date and time the boot PROM was updated.
`Firmware_Version_Information`	FOS version information. For example, `v2.0`.
`Switch_Operational_Status`	The switch's current operational status to an external Fibre Channel port, as followings: 1 – Online, the switch is accessible 2 – Offline, the switch is not accessible 3 – Testing, the switch is in testing, is not accessible, and SESD is not available. 4 – Faulty, the switch is faulty, is not accessible, and SESD is not available.
`Switch_Administrative_Status`	The switch's desired administrative status. An SES client may place the switch in a desired state by setting this field, as follows: 1 – Online, the switch is accessible 2 – Offline, the switch is not accessible (and SESD is not available) 3 – Testing, the switch not accessible and SESD is not available 4 – Faulty, the switch not accessible and SESD is not available 5 – Reboot, the switch reboots 6 – Fastboot, the switch performs a warm boot (skipping POST)

Table 4-21 Switch Page Field Descriptions(Continued)

`Diagnostics_Result`	POST result and is one of the following integer value: 1 – OK 2 – Central memory fault 3 – Embedded port fault
`Number_of_Sensors`	Number of sensors in the switch.

Sensor Table Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command, the SESD returns the response shown in Table 4-22. Table 4-23 describes the fields.

Table 4-22 Sensor Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	rw	Page Code = 81h	1
1	na	na	Reserved = 0	1
2 .. 3	na	ro	Page Length = *n* - 3	2
4 .. 7	na	ro	swNumEntries = *i* – specifies the number of set entries received for bytes 8 -91, if the number is 5 there are 5 sets of outputs for bytes 8 - 91.	4
8 .. 11	na	ro	swValidity[0] = 1Fh	4
12 .. 15	0	ro	swSensorIndex[0]	4
16 .. 19	1	ro	swSensorType[0]	4
20 .. 23	2	ro	swSensorStatus[0]	4
24 .. 27	3	ro	swSensorValue[0]	4
28 .. 91	4	ro	swSensorInfo[0]	64
..	... more instances of swSensorEntry (swValidity .. swSensorInfo) if applicable...			...
(*n-63*).. *n*	4	ro	swSensorInfo[*i-1*]	64
Note: na is not available, ro is read only and rw is read/write				

Table 4-23 Sensor Table Page Field Descriptions

FIELD	DESCRIPTION
`swSensorIndex`	Identifies the sensor
`swSensorType`	Identifies the sensor type (enumerate the values)

Table 4-23 Sensor Table Page Field Descriptions(Continued)

`swSensorStatus`	Current sensor status:
	`1 = unknown`
	`2 = faulty`
	`3 = below-min`
	`4 = nominal`
	`5 = above-max`
	`6 = absent`

`swSensorValue`	Current value (reading) of the sensor. The value, `-2147483648`, represents an unknown quantity. It also means that the sensor does not have the capability to measure the actual value. The temperature sensor value is in Celsius, the fan value is in RPM (revolution per minute), and the power supply sensor reading is unknown.
`swSensorInfo`	Additional information on the sensor. It contains the sensor type and number in textual format. For example, `’Temp 3’`, `’Fan 6’`.

Fabric Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command, the SESD returns the response shown in Table 4-24. Table 4-25 describes the fields.

Table 4-24 Fabric Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 82h	1
1	na	na	Reserved	1
2 .. 3	na	na	Page Length = 20	2
4 .. 7	na	ro	swValidity = 7	4
8 .. 11	0	ro	swDomainID	4
12 .. 15	1	ro	PrincipalSwitchFlag	4
16 .. 19	2	ro	NumberOfImmediateNeighbor	4
20 .. 23	3	ro	reserved for NumberOfFabricISL_Entries *	4
Note: na is not available, ro is read only and rw is read/write * the Fabric wide ISL table is not supported.				

Table 4-25 Fabric Page Field Descriptions

FIELD	DESCRIPTION
`swDomainID`	Current Fibre Channel domain ID of the switch.

`PrincipalSwitchFlag`	Indicates whether the switch is the Principal switch as per FC-SW:
	`1 = yes`
	`2 = no`

Table 4-25 Fabric Page Field Descriptions(Continued)

`NumberOfImmediateNeighbor`	The number of Inter-Switch Links in the (immediate) neighborhood.

Neighborhood Table Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command, the SESD returns the response shown in Table 4-26. Table 4-27 describes the fields.

Table 4-26 Neighborhood Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 83h	1
1	na	na	Reserved	1
2 .. 3	na	na	Page Length = *n* - 4	2
4 .. 7	na	na	swNumEntries = *i* – specifies the number of set entries received for bytes 8. Note that each entry consists of swValidity[0] field through swNbIslState[0] field.	4
8 .. 11	na	ro	swValidity[0] = 3Fh	4
12 .. 15	0	ro	swNbIndex[0] = 1	4
16 .. 19	1	ro	swNbMyPort[0]	4
20 .. 23	2	ro	swNbRemoteDomain[0]	4
24 .. 27	3	ro	swNbRemotePort[0]	4
28 .. 31	4	ro	swNbBaudRate[0]	4
32 .. 35	5	ro	swNbIslState[0]	4
..	... more instances of swNbEntry (swValidity .. swNbIslState) if applicable ...			...
(*n-4*)..(*n-1*)	0 - 5	ro	swNbIslState[*i-1*]	4
Note: na is not available, ro is read only and rw is read/write				

Table 4-27 Neighborhood Table Page Field Descriptions

FIELD	DESCRIPTION
`swNbIndex`	Identifies the neighbor ISL entry
`swNbMyPort`	The port index that has an ISL to another switch
`swNbRemDomain`	Fibre Channel domain on the other end of the ISL
`swNbRemPort`	Port index on the other end of the ISL

Table 4-27 Neighborhood Table Page Field Descriptions(Continued)

`swNbBaudRate`	The baud rate of the ISL which should be 16 for 1 gigabit
`swNbIslState`	The current state of the ISL which should be 5 for active

Fibre Channel Port Table Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command the SESD returns the response shown in Table 4-28. Table 4-29 describes the fields.

Table 4-28 Fibre Channel Port Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 84h	1
1	na	na	Reserved	1
2 .. 3	na	na	Page Length = *n* - 4	2
4 .. 7	na	na	swNumEntries = *i* – specifies the number of set entries received. Note that each entry consists of swValidity[0] field through swFCPortLipLastAlpa field.	4
8 .. 11	na	rw	swValidity[0] = FFFFFFFh	4
12 .. 15	0	ro	swFCPortIndex[0]	4
16 .. 19	1	ro	swFCPortType[0]	4
20 .. 23	2	ro	swFCPortPhyState[0]	4
24 .. 27	3	ro	swFCPortOpStatus[0]	4
28 .. 31	4	rw	swFCPortAdmStatus[0]	4
32 .. 35	5	ro	swFCPortTxWords[0]	4
36 .. 39	6	ro	swFCPortRxWords[0]	4
40 .. 43	7	ro	swFCPortTxFrames[0]	4
44 .. 47	8	ro	swFCPortRxFrames[0]	4
48 .. 51	9	ro	swFCPortTxC2Frames[0]	4
52 .. 55	10	ro	swFCPortTxC3Frames[0]	4
56 .. 59	11	ro	swFCPortRxLCs[0]	4
60 .. 63	12	ro	swFCPortRxMcasts[0]	4
64 .. 67	13	ro	swFCPortTooManyRdys[0]	4
68 .. 71	14	ro	swFCPortNoTxCredits[0]	4
72 .. 75	15	ro	swFCPortRxEncInFrs[0]	4

Table 4-28 Fibre Channel Port Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
76 .. 79	16	ro	swFCPortRxCrcs[0]	4
80 .. 83	17	ro	swFCPortRxTruncs[0]	4
84 .. 87	18	ro	swFCPortRxTooLongs[0]	4
88 .. 91	19	ro	swFCPortRxBadEofs[0]	4
92 .. 95	20	ro	swFCPortRxEncOutFrs[0]	4
96 .. 99	21	ro	swFCPortRxBadOs[0]	4
100 .. 103	22	ro	swFCPortRxC3Discards[0]	4
104 .. 107	23	ro	swFCPortMcastTimedouts[0]	4
108 .. 111	24	ro	swFCPortTxMcasts[0]	4
112 .. 115	25	ro	swFCPortLipIns[0]	4
116 .. 119	26	ro	swFCPortLipOuts[0]	4
120 .. 123	27	ro	swFCPortLipLastAlpa[0]	4
..	... more instances of swFCPortEntry (swValidity .. swFCPortLipLastAlpa) if applicable ...			...
(*n-3*)..*n*	0 - 27	ro	swFCPortLipLastAlpa[*i-1*]	4
Note: na is not available, ro is read only and rw is read/write				

Table 4-29 Neighborhood Table Page Field Descriptions

FIELD	DESCRIPTION
`swFCPortIndex`	Identifies the switch port index. Note that the value of a port index is 1 higher than the port number labeled on the front panel. For example, port index 1 correspond to port number 0.
`swFCPortType`	Identifies the type of switch port. It may be of type `stitch(1)`, `flannel(2)` or `loom(3)`.

Table 4-29 Neighborhood Table Page Field Descriptions(Continued)

`swFCPortPhyState`	Identifies the physical state of the port, as follows: `noCard(1)` – no card present in this switch slot `noGbic(2)` – no GBIC module in this port `laserFault(3)` – the module is signaling a laser fault (defective GBIC) `noLight(4)` – the module is not receiving light `noSync(5)` – the module is receiving light but is out of sync `inSync(6)` – the module is receiving light and is in sync `portFault(7)` – the port is marked faulty (defective GBIC, cable or device) `diagFault(8)` – the port failed diagnostics: defective G_Port or FL_Port card or motherboard `lockRef(9)` – the port is locking to the reference signal
`swFCPortOpStatus`	Identifies the port's operational status. The `online(1)` state indicates that user frames can be passed. The `unknown(0)` state indicates that likely the port module is physically absent (see `swFCPortPhyState`).
`swFCPortAdmStatus`	The port's desired state. A management station may place the port in a desired state by setting this object accordingly. The `testing(3)` state indicates that no user frames can be passed. As the result of either explicit management action or per configuration information accessible by the switch, `swFCPortAdmStatus` is then changed to either the `online(1)` state, `testing(3)` state, or remains in the `offline(2)` state.
`swFCPortTxWords`	Counts the number of Fibre Channel words that the port has transmitted.
`swFCPortRxWords`	Counts the number of Fibre Channel words that the port has received.
`swFCPortTxFrames`	Counts the number of (Fibre Channel) frames that the port has transmitted.
`swFCPortRxFrames`	Counts the number of (Fibre Channel) frames that the port has received.
`swFCPortTxC2Frames`	Counts the number of Class 2 frames that the port has transmitted.
`swFCPortRxC3Frames`	Counts the number of Class 3 frames that the port has received.
`swFCPortRxLCs`	Counts the number of Link Control frames that the port has received.
`swFCPortRxMcasts`	Counts the number of Multicast frames that the port has received.
`swFCPortTooManyRdys`	Counts the number of times when RDYs exceeds the frames received.
`swFCPortNoTxCredits`	Counts the number of times when the transmit credit has reached zero.
`swFCPortRxEncInFrs`	Counts the number of encoding error or disparity error inside frames received.
`swFCPortRxCrcs`	Counts the number of CRC errors detected for frames received.
`swFCPortRxTruncs`	Counts the number of truncated frames that the port has received.
`swFCPortRxTooLongs`	Counts the number of received frames that are too long.
`swFCPortRxBadEofs`	Counts the number of received frames that have bad EOF delimiter.
`swFCPortRxEncOutFrs`	Counts the number of encoding error or disparity error outside frames received.

Table 4-29 Neighborhood Table Page Field Descriptions(Continued)

`swFCPortRxBadOs`	Counts the number of invalid Ordered Sets received.
`swFCPortC3Discards`	Counts the number of Class 3 frames that the port has discarded.
`swFCPortMcastTimedOuts`	Counts the number of Multicast frames that have been timed out.
`swFCPortTxMcasts`	Counts the number of Multicast frames that have been transmitted.
`swFCPortLipIns`	Counts the number of Loop Initializations that have been initiated by loop devices attached.
`swFCPortLipOuts`	Counts the number of Loop Initializations that have been initiated by the port.
`swFCPortLipLastAlpa`	Indicates the Physical Address (AL_PA) of the loop device that initiated the last Loop Initialization.

Name Server Local Table Page

If requested using the `Send Diagnostic` or `Receive Diagnostic Result` command, the SESD returns the following response as shown in Table 4-30. Table 4-31 describes the fields.

Table 4-30 Name Server Local Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 85h	1
1	na	na	Reserved	1
2 .. 3	na	na	Page Length = *n* - 3	2
4 .. 7	na	na	swNumEntries = *i* – specifies the number of set entries received. Note that each entry consists of swValidity[0] field through swNsFc4Types[0] field.	4
8 .. 11	na	ro	swValidity[0] = 7FFh	4
12 .. 15	0	ro	swNsEntryIndex[0]	4
16 .. 19	1	ro	swNsPortType[0]	4
20 .. 23	2	ro	swNsPortID[0]	4
24 .. 31	3	ro	swNsPortName[0]	8
32 .. 287	4	ro	swNsPortSymb[0]	256
288 .. 295	5	ro	swNsNodeName[0]	8
296 .. 551	6	ro	swNsNodeSymb[0]	256
552 .. 559	7	ro	swNsIPA[0]	8
560 .. 575	8	ro	swNsIpAddress[0]	16
576 .. 579	9	ro	swNsCos[0]	4

Table 4-30 Name Server Local Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
580 .. 611	10	ro	swNsFc4[0]	32
612 .. 615	na	ro	swValidity[1] - if applicable (n > 612)	4
...	... more instances of swNsEntry as applicable...			...
Note: na is not available, ro is read only and rw is read/write				

Table 4-31 Name Server Local Table Page Field Descriptions

FIELD	DESCRIPTION

`swNsEntryIndex`	Identifies the Name Server database entry:
	`0 = unknown`
	`1 = nPort`
	`2 = nlPort`

`swNsPortType`	Identifies the port type: N_Port, NL_Port, etc., for this entry. The type is defined in FC-GS-2.
`swNsPortID`	Identifies the Fibre Channel port address ID of the entry.
`swNsPortName`	Identifies the Fibre Channel WWN of the port entry.
`swNsPortSymb`	Identifies the Symbolic Name contents of the port entry. In FC-GS-2, a Symbolic Name consists of a byte array of 1 through 256 bytes and the first byte of the array specifies the length of its *contents*.
`swNsNodeName`	Identifies the Fibre Channel WWN of the associated node as defined in FC-GS-2.
`swNsNodeSymb`	Identifies the Symbolic Name contents of the node associated with the entry. In FC-GS-2, a Symbolic Name consists of a byte array of 1 through 256 bytes and the first byte of the array specifies the length of its *contents*.
`swNsIPA`	Identifies the Initial Process Associator of the node for the entry as defined in FC-GS-2.
`swNsIpAddress`	Identifies the IP address of the node for the entry as defined in FC-GS-2. The address format is in IPv6.
`swNsCos`	Identifies the class of services supported by the port. The value is a bit-map defined as follows: bit 0 is class F bit 1 is class 1 bit 2 is class 2 bit 3 is class 3 bit 4 is class 4 etc.
`swNsFc4`	Identifies the FC-4s supported by the port as defined in FC-GS-2.

Port Error and Interrupt Statistics Table Page

If requested using the `Receive Diagnostic Result` command, the SESD returns the following response as shown in Table 4-32. The fields are described from the Telnet `portShow` command in Table 4-33

Table 4-32 Port Error and Interrupt Statistics Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 87h	1
1	na	na	Reserved	1
2 .. 3	na	na	Page Length = *n* -3	2
4 .. 7	na	na	swNumEntries = *i*	4
8 .. 11	na	ro	swValidity[0] = 7FF1FFFh	4
12 .. 15	0	ro	swFCPortIndex[0]	4
16 .. 19	1	ro	swFCPortLinkFailures[0]	4
20 .. 23	2	ro	swFCPortSyncLosses[0]	4
24..27	3	ro	swFCPortSignalLosses[0]	4
28..31	4	ro	swFCPortPrimSeqProtoErrors[0]	4
32..35	5	ro	swFCPortInvalidTxWords[0]	4
36..39	6	ro	swFCPortInvalidCrcs[0]	4
40..43	7	ro	swFCPortDelimiterErrors[0]	4
44..47	8	ro	swFCPortAddressIdErrors[0]	4
48..51	9	ro	swFCPortLinkResetIns[0]	4
52..55	10	ro	swFCPortLinkResetOuts[0]	4
56..59	11	ro	swFCPortOlsIns[0]	4
60..63	12	ro	swFCPortOlsOuts[0]	4
64..67	13	ro	reserved	4
68..71	14	ro	reserved	4
72..75	15	ro	reserved	4
76..79	16	ro	TotalNumberOfInterrupts (sum of subsequent interrupts below)	4
80..83	17	ro	UnknownInterrupts	4
84..87	18	ro	LinkLevelInterrupts	4
88..91	19	ro	ProcessingRequiredInterrupts	4
92..95	20	ro	TimedoutInterrupts	4

Table 4-32 Port Error and Interrupt Statistics Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
96..99	21	ro	RxFlushedInterrupts	4
100..103	22	ro	TxUnavailableInterrupts	4
104..107	23	ro	FreeBufferInterrupts	4
108..111	24	ro	OverrunInterrupts	4
112..115	25	ro	Suspended_Interrupts	4
116..119	26	ro	ParityErrorInterrupts	4
120..123	27	ro	reserved_last	4
...	more instances of (swValidity..reserved_last) if applicable			

Table 4-33 Port Error and Interrupt Statistics Table Page Command Field Descriptions

TYPE	FIELD	DESCRIPTION
Error Statistics	`swFCPortLinkFailures`	Number of link failures.
	`swFCPortSyncLosses`	Loss of synchronization.
	`swFCPortSignalLosses`	Loss of signal (no light).
	`swFCPortPrimSeqProtoErrors`	Protocol error.
	`swFCPortInvalidTxWords`	Invalid word (encoding errors inside of frames).
	`swFCPortInvalidCrcs`	Invalid CRC in a frame.
	`swFCPortDelimiterErrors`	Delimeter error (order set)
	`swFCPortAddressIdErrors`	Address id error (S_ID D_ID)
	`swFCPortLinkResetIns`	Link reset in (primitive sequence). Does not apply to FL_Port.
	`swFCPortLinkResetOuts`	Link reset out (primitive sequence). Does not apply to FL_Port.
	`swFCPortOlsIns`	Offline resent in (primitive sequence). Does not apply to FL_Port.
	`swFCPortOlsOuts`	Offline resent in (primitive sequence). Does not apply to FL_Port.
Interrupt Statistics	`TotalNumberOfInterrupts`	Total number of interrupts.
	`UnknownInterrupts`	Number of interrupts not counted in all other categories.
	`LinkLevelInterrupts`	Number of low level interface (LLI) interrupts

Table 4-33 Port Error and Interrupt Statistics Table Page Command Field Descriptions(Continued)

TYPE	FIELD	DESCRIPTION
	`ProcessingRequiredInterrupts`	Number of interrupts with processing (CPU) required.
	`TimedoutInterrupts`	Number of timed out interrupts.
	`RxFlushedInterrupts`	Number of flushed transmissions.
	`TxUnavailableInterrupts`	Number of interrupted transmissions
	`FreeBufferInterrupts`	Number of buffer interrupts.
	`OverrunInterrupts`	Number of buffer overruns.
	`Suspended_Interrupts`	Number of suspended interrupts
	`ParityErrorInterrupts`	Number of parity errors.

Fabric Inquiry Data Page

If requested using the `Receive Diagnostic Result` command the SESD returns the response shown in Table 4-34. Table 4-35 describes the fields.

Table 4-34 Fabric Inquiry Data Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 8Ah	1
1	na	na	Reserved	1
2..3	na	na	Page Length =*n - 3*	2
4..7	na	ro	swValidity = FEFh	4
8..15	0	ro	switchWorld_wide_name	8
16..31	1	ro	switchName	32
47..51	2	ro	switchModelInfo	4
52..55	3	ro	firmwareVersion	4
56..119	4	ro	Reserved	64
120..123	5	ro	numberOfIpInterfaces = *i*	4
124..127	6	ro	interfaceType[0]	4
128..143	7	ro	interfaceName[0] - in ASCII format	16
144..159	8	ro	ipAddress[0] in IPv6 format	16
...			...	...
(n-15)..n	0 - 8	ro	ipAddress[i-1] in IPv6 format	16

Table 4-35 Fabric Inquiry Data Page Field Descriptions

FIELD	DESCRIPTION
`switchWorld_wide_Name`	The switch's Worldwide Name, the format is as defined in the Fibre Channel Standards.
`switchName`	The switch name in ASCII text and terminated with a null character; this name is the same as the one displayed by the Telnet command, `switchName` or the MIB-II variable, `sysName`.
`switchModelInfo`	The first two bytes (byte 32 and 33) are reserved; the third byte (byte 34) represents the product model (1 for SilkWorm 1000 series; 2 for SilkWorm 2800; 3 for SilkWorm 2400) and fourth byte (byte 35) represents the revision of the motherboard.
`firmwareVersion`	A 4 byte ASCII string of the format `v{N}{m}{p}`, as follows: `{N}` is a single number designating the major firmware release number `{m}` is a single number designating the minor release number `{p}` is a single alpha character designating a patch; `{p}` may be a space indicating that there is no patch An example of this value is `v20`. See the Product revision level in the `Inquiry Data Page`.
`numberOfIpInterfaces`	This is an integer indicating the number of IP interfaces supported by the switch. This number is likely to be 2. This also indicates how many interface entries follow. Each interface entry contains the interface type, interface name and its IP address.
`interfaceType`	This value designates the type of network (IP) interface type as defined in RFC1213 - MIB-II. Note that the following enumerated values would apply: `ethernetCsmacd(6)` – for the Ethernet interface `fibreChannel(56)` – for the Fibre Channel interface
`interfaceName`	A 16 byte ASCII text representing the name of the interface
`ipAddress`	The IP address of the interface in IPv6 format

MIB-II System Group Page

If requested using the `Receive Diagnostic Result` command the SESD returns the response shown in Table 4-36. This page contains the System Group, SNMP MIB-II, as defined in the Internet Engineering Task Force (IETF) standard document, RFC 1213. SNMP is a popular network management protocol that is based on TCP/IP protocol suite. Table 4-37 describes the fields.

Table 4-36 MIB-II System Group Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = 90h	1
1	na	na	Reserved	1
2..3	na	na	Page Length =1200	2

Table 4-36 MIB-II System Group Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
4..7	na	ro	swValidity = 7Dh	4
8..263	0	ro	sysDescr	256
264..427	1	na	reserved for sysObjectID - it seems pointless to map this variable at present; note that bit 1 in validity will be set to 0.	164
428..431	2	ro	sysUpTime	4
432..687	3	ro	sysContact	256
688..943	4	ro	sysName	256
944..1199	5	ro	sysLocation	256
1200..1203	6	ro	sysServices	4

Table 4-37 MIB-II System Group Page Field Descriptions

FIELD	DESCRIPTION
`sysDescr`	System (switch) description is also available as the `Product Identification` field of the standard `Inquiry Data` (see Table 4-8). If `sysDescr` is more than 16 bytes long, then only the first 16 bytes are mapped to the Product Identification field. This information may be set with the Telnet command, `agtcfgSet` or the SNMP-SET request. The factory default value is `FC Switch`.
`sysUpTime`	The time, in hundredths of a second, since the SNMP agent was started (at boot time).
`sysContact`	The textual identification of the contact person for this managed switch, together with information on how to contact this person. This information may be set with the Telnet command, `agtcfgSet` or the SNMP-SET request. The factory default value is `Field Support`.
`sysName`	An administratively assigned name for this switch. This information may be set with the Telnet command, `switchName` or the SNMP-SET request.
`sysLocation`	The physical location of this switch. This information may be set with the Telnet command, `agtcfgSet`, or the SNMP-SET request. The factory default value is `End User Premise`.
`sysServices`	A value which indicates the set of (network) services that this switch firmware offers. Initially, the sum value is zero. For each (network) layer, L, in the range 1 through 7, that the Fabric Operating System (FOS) performs transaction for, 2 raised to (L-1) is added to the sum. In the context of the Internet suite of protocols, values should be calculated accordingly: **layer** – **functionality** 1 – physical 2 – datalink/subnetwork 3 – internet 4 – end-to-end 7 – applications This value is set to 79. That is, layers 1, 2, 3, 4 and 7 are supported.

PortLog Table Page

If requested using the `Receive Diagnostic Result` command the SESD returns the response shown in Table 4-38. To interpret the contents of this page a UNIX utility, `portlogDump`, is provided.

Table 4-38 PortLog Table Page Format

BYTE	FIELD #	ACCESS	DESCRIPTION	SIZE
0	na	na	Page Code = B0h	1
1	na	na	Reserved	1
2..3	na	na	Page Length = *n* - 3	2
An array of p portlog entries to follow, as applicable, where p = (n-3)/36				
4	0	ro	reserved[0]	1
5	1	ro	duplicate_count[0]	1
6	2	ro	portNumber[0]	1
7	3	ro	logType[0]	1
8..11	4	ro	argument0[0]	4
12..15	5	ro	argument1[0]	4
15..19	6	ro	argument2[0]	4
20..23	7	ro	argument3[0]	4
24..27	8	ro	taskID	4
28..31	9	ro	timeStamp_sec[0]	4
32..35	10	ro	timeStamp_nanoSec[0]	4
...			... more instances of the above as applicable	

5

TROUBLESHOOTING

This chapter discusses the `SEND DIAGNOSTIC` command error messages.

License Reject

A license reject is generated when the SES license key is improperly entered or isn't installed. Note that the license key when installed *must be in double quotes* (*"key"*).

The following message is generated:

Probable cause:	Invalid Field
Action:	See *Reject* on page 4-9 for more information.

CHECK CONDITION

`CHECK CONIDITION` is generated when the SES Device (SESD) terminates an operation because an error was encountered. These error conditions can be from invalid operations, warning indications and failure conditions. The sense key and sense code describe the error.

Invalid Field Errors

`ILLEGAL REQUEST` is generated from any invalid fields in the CDB, from parameters of a `SEND DIAGNOSTIC` command and from the CDB of a `RECEIVE DIAGNOSTIC RESULTS` command. The sense code identifies the location of the invalid fields, parameter or CDB.

The following message is generated:

Probable cause:	Invalid Field
Action:	See *Reject* on page 4-9 for more information.

A

GLOSSARY

The following terms relate to SES and Fibre Channel connections.

Definition of Terms

Application Client	The source object of the SCSI commands and destination for the command responses.
Command Descriptor Block	The structure of up to 16 bytes in length used to communicate commands from the application client to a device server.
Device Server	A logical unit object that executes SCSI tasks.
Device Service Request	A request from an application client of SCSI commands to a device server.
Device Type	The device type or device model implemented by the device server.
Domain_ID	The domain number uniquely identifies the switch in a Fabric. Normally the switch domain ID is automatically assigned by the principal switch. It may have any integer value between 1 and 239. If the switch is set in the "VC Encoded" mode, the value will be from 0 through 31. This number may also be assigned manually.
Enclosure	The box, rack or box set that provide power, mechanical protection, external interfaces and cooling for the SCSI device(s).
Enclosure Services	The services that establishes indicators and controls for the proper operation and maintenance of devices within the enclosure.

Enclosure Services Device	A SCSI device that monitors and controls enclosure services. The switches imbedded port.
Initiator	A SCSI device containing application clients that originate device service requests to be processed by the device servers.
Logical Unit	A target-resident entity that implements a device model and executes SCSI commands originated by an application client.
Logical Unit Number	A device or element known by an enclosure that identifies it to the application client.
SCSI	Small Computer Systems Interface.
SCSI Device	A device that is connected to a service delivery subsystem and supports the SCSI application protocol.
Redundancy	The presence in an enclosure of one or more elements capable of automatically taking over the functions of a failed element.
Target	A SCSI device that receives SCSI commands and directs such commands to one or more logical units for execution.

B

SES SPECIFICATIONS

This appendix lists the SilkWorm SES Specifications, they are:

- SES Management
- Fabric Operating System Support

SES Management

- FCP Connection to Management Server (`FFFFFAh`)
- *Currently, SES is in the DRAFT status and is subject to change*. See “Related Publications” on page viii for a pointer to the SES Standards Committee’s web site.

Fabric Operating System Support

- Fabric OS, Version 2.0 and above

Available MIB and Trap Files

You can download the MIB definitions and Brocade Enterprise Traps Definition from:

- From a web browser, connect to:

  http://www.brocade.com/BrocMarket.nsf/Support/Mibs&Rsh

C

CUSTOMER SUPPORT

Support for your switch can be obtained from the supplier of your switch. Please contact the supplier to report hardware or software problems. The supplier is also the correct source for switch repairs or for supplying spare components.

Support Tool

Included in the switch software is a command that will provide a display of a variety of information that is helpful in diagnosing switch related problems. This command is: *suppportShow*. This command can be entered into a telnet session command window and the results should be saved and supplied to your support contact.

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